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ABSTRACT

At the University of Minnesota, a model, visual representation or "graphic" that incorporated both a systematic design process and a constructivist approach was used as a framework for course design. This paper describes experiences of applying the Instructional Context Design (ICD) framework in both the K-12 and higher education settings. The first application involved creating a fifth grade writing assignment that was motivating, short-term, and still incorporated both research and creativity. The second application involved developing a post-baccalaureate course called "Art Media Techniques: Computers." The ICD concept seemed to work well as a framework for developing the courses within the constructivist philosophy; the paper includes discussion on the origins of that concept and on two sets of relevant theoretical criteria. Dunn's modified questions for constructivist design focus on whether the materials are appropriate to the learning outcome: if they include adequate instruction on the subordinate skills; if they are clear and readily understood by representative members of the target group; the motivational value and relevance of the materials; and whether they can be managed efficiently in the manner mediated. Richey identified six core elements of systematic design processes, which include: determining learner needs; determining goals and objectives; constructing assessment procedures; designing and/or selecting delivery approaches; testing the instructional system; and installing and maintaining the system. It was concluded that attention to the context of learning and to how that context facilitates learning, is the "value added" by adopting a constructivist epistemology in instructional design. (Contains 19 references.) (AEF)

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A Constructivist Design and Learning Model: Time for a Graphic

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Introduction

The current uproar that is the field of education in the 1990's seems to place almost every aspect of teaching and learning into question. The battles that stem from major philosophic differences tend to permeate not only educational philosophies and research, but curriculum development and instructional practice as well. In instructional design, such philosophic debate has manifested as a tension between instructivist and constructivist approaches. Designing instruction, in this environment, becomes a statement of the underlying assumptions about knowledge and learning held by the designer and the client, as well as a definition of the roles of the teacher and students who experience the instruction.

Even though the instructivist and constructivist instructional design approaches appear to be at odds, attempts have been made to marry the two:

> For ID [instructional design], this means primarily re-integrating design with instructional delivery so that the interaction between student and instruction becomes more adaptive to situations that vary from one problem to the next. It also means the development of learning environments in which students construct knowledge for themselves. For their part, proponents of SL [situated learning] need to develop effective ways for bringing authentic activity into the classroom.... I expect that with a serious attempt to adapt ID to SL and vice versa, powerful and innovative learning environments can be built to the benefit of all who work in them (Winn, 1993, p. 20).

At the 1995 AECT National Convention, three different presentations on constructivist instructional design were offered which attempted to answer Winn's call for "innovative learning environments" and the merger of instructivist and constructivist design: (a) the "Layers of Negotiation Model" (Cennamo, Abell, & Chung, 1995), (b) a design for graduate school courses (Wager, Lebow, Driscoll, & Supinski, 1995), and (c) a design for a series of business courses (Cognitive Learning Group, 1995). Though all three presentations were clearly based on both constructivist theory and on recommendations from the literature, such as Driscoll's (1994) five conditions for constructivist learning environments, no attempt was made to present a visual model. Cennamo et al., (1995) came closest when they described the Layers of Negotiation Model as a spiral, yet they did not offer a graphic representation of the spiral process.

While visual or graphic models in instructional design that follow an instructivist philosophy are readily available (Dick & Carey, 1990; Gagné, Briggs, & Wager, 1992), participants in the philosophical debates, theoretical discussions, and design efforts in constructivist learning environments have not, to our knowledge, produced a visual representation of constructivist instructional design. One might, at first blush, question the need for another instructional design model. Yet, when we were faced with designing and developing our own new courses following a constructivist philosophy; we found that a model, visual representation, or "graphic" that incorporated both a systematic design process and a constructivist approach could provide a useful framework for efficient design.

In this paper, we present our design processes for two different learning contexts. These processes are based in part on the inspiration gained from the presentations of Cennamo et al., Wager et al., and the Cognitive Learning Group at the 1995 AECT convention. We also draw upon instructional design research and on the larger community of educational research to (a) present a three-part design framework based on the core instructional models first proposed by Sylvia Farnham-Diggory (1994) and the stages of learning described by Jonassen (1991a), (b) examine the framework's integrity and usefulness by asking five questions first posed by Dick and Carey (1990) and explored by Dunn in his review of constructivist philosophy (Dunn, 1994) , and (c) briefly describe how the framework answers questions that concern learning raised in constructivist/instructivist discussions (Driscoll, 1994; Jonassen, 1991b).

We must hasten to state that we are not interested in prescribing a series of events or designing from discrete stages (Cennamo et al., 1995) in our presentation of a constructivist model of instructional design. Instead, we approach a constructivist model of instructional design both from the design perspective and from the learner's context. In considering constructivist instructional design, or more accurately, *instructional context design*, the larger contexts of designer, teacher, and learner are incorporated into a framework that supports a context-sensitive teaching/learning environment rather than a prescriptive recipe for delivering content.

This concept of our visual representation as a framework rather than a prescriptive model for constructivist educational design is important. Rather than establish a specific set of steps, we envision a *supportive structure*, within which constructivist design might take place. This supportive structure is similar in spirit to Constructivist art of the 1920's with its "emphasis upon the structural aspect of the work of art [which] led to the concept of constructed art" (Hamilton, 1972,p. 235). Similarly in constructivist instructional design, the design framework with its focus on the context of learning, promotes the construction of learning within each context.

Origins of the Concept

Reflecting on our past instructional design projects, we recalled that the design models which had been most helpful to us were those which provided a direct connection between design steps and an organized approach to learning theory. The "Stages in Designing Instructional Systems," as integrated with Gagné's "Events of Instruction" (Gagné, et al., 1992) was favored by one of us in early instructional design projects. The other used Tennyson and Rasch's "Instructional Planning Model," which offered "a model of instructional design that links various forms of cognitive learning to appropriate methods of instruction" (Tennyson & Rasch, 1988, p. 369).

While the experiences reported by Cennamo et al., Wager et al., and the Cognitive Learning Group made it clear that constructivist design could not be reduced to a linear series of prescribed steps, we approached our consideration of a framework for instructional context design with the belief that, even in a non-linear design process, a conceptual link to learning theory remained vital. However, taxonomies or lists of learning conditions seemed more congruent with linear design models than with the spiraling or layered process of constructivist design that the various presenters at the 1995 AECT convention described.

Therefore, we sought a non-hierarchical conceptual model of learning theory which would be simple, inclusive, and flexible. We found that combination of characteristics in the three core instructional models (linked to five types of acquired knowledge) described and delimited by Sylvia Farnham-Diggory in her 1994 analysis of educational research literature. Farnham-Diggory maintains that:

> Every instructional program ... can be described as fitting one of three mutually exclusive models ... *behavior*, *development*, or *apprenticeship*. ... [T]he nature of the model is determined by two factors: how the model distinguishes novices from experts and what the mechanism of transformation is (1994, p. 464).

In the behavior model, novices are distinguished from experts by quantitative differences on the same scale. The mechanism of transformation is what Farnham-Diggory terms "incrementation," getting better, faster, or going higher on a quantitative scale. The development model distinguishes between experts and novices by differences in qualitative measures, such as personal beliefs and attitudes. The change is accomplished through "perturbation," the challenging of personal theory.

In the apprenticeship model, "experts and novices are from different worlds" (p. 466). The transformative process is "acculturation," that is, one learns about expertise by living in the culture of the expert. Farnham-Diggory maintains that within each of these three instructional models, any of five types of knowledge can be acquired: declarative, procedural, conceptual, analogical, and logical

As we began to create our visual representation of constructivist instructional design, we were guided by David Jonassen's assertion that designers cannot always control what individuals learn, but that they can aspire to design environments which support learners in their learning (Jonassen, 1991a). We adopted his concept of three stages of knowledge acquisition (initial, advanced, expertise) (Jonassen, 1991b), each entailing different types of learning (practice/feedback for the initial stage of learning, apprenticeship/coaching for the advanced stage, experience for the expert stage), the whole forming a continuum of learning and experience. These stages, used in conjunction with the Farnham-Diggory instructional models, illustrate the multiple combinations of learner characteristics, instructional approaches, and content types which can interact in an instructional context, and which must be addressed in the design process.

The task for a constructivist designer is to create an instructional context rich in experiences which, in interaction with the learner, may provide for the development of expertise. We use the terms "expert" and "novice" relatively, as does Farnham-Diggory (1994, p. 464). One could, for example, be expert at recognizing the upper case "A", or be a novice at diagnosing a particular variety of influenza. The instructional context designed for learners in each situation might draw on a combination of the instructional models in creating an environment supportive of the learner's development within that content domain.

While Farnham-Diggory defines the three instructional models as mutually exclusive, she recognizes that more than one can function concurrently within an instructional program. Current research (Eisner, 1993; Salomon, 1991) suggests that sharp delimiters between such models or levels are rare in real learning contexts. Within the same content domain, learners may be novices in some elements and more expert at other elements, yet overall be categorized at a developmental stage within the larger focus of the domain (two examples will be discussed later in the paper). With this

in mind, we attempted to include in our visualization of instructional context design some means of illustrating the gray areas between and among the three core learning models and the stages of knowledge acquisition.

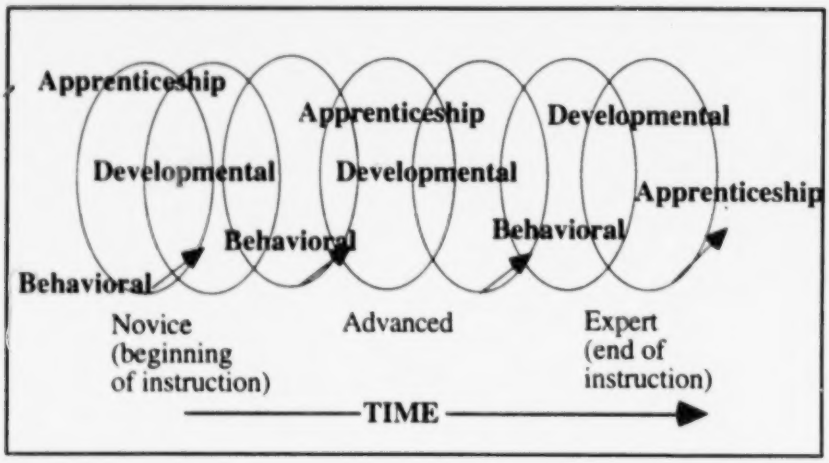
Creating the Visualization

Learning context, with all of its gray areas, complexities, and uncontrollable variables, became the focus of our conceptual model. The challenge from Winn (1993) to create "innovative learning environments" (p. 20), and the process of "spiral cycles rather than discreet stages" described by Cennamo et al. (1995, p.40), shaped our concept of an instructional context as a circular "tunnel" through which the learner passes while experiencing the lesson, course, or instructional system (see Figure 1). Within the tunnel, all experiences, materials, interactions, and communications, combine with the learner's prior knowledge to create the instructional context which is designed with the intent of stimulating the learner to construct knowledge relevant to the goals of the learning experience. As learners pass through the instructional context tunnel, they will progress from the novice level to some level of greater expertise in the relevant content domain. Thus the concept of a spiral tunnel attempts to include variables that enter into any learning context as well as the intended content of the learning experience.

Viewed over time, that is, over the length of the course, semester, or learning experience; the tunnel appears as an expanded coil spring through the center of which the learner passes as time passes in the learning environment (see Figure 2). The spiral bands represent the three core instructional models as they are cycled through repeatedly by the learner during the process of experiencing the learning context over time. The overall tunnel segment (from the "beginning" of the instruction to the "end" of instruction) represents the gradual progress through the novice, advanced, and expert levels of learning.

Figure 1. A cross-sectional view of the Instructional Context Design tunnel illustrating three core instructional paradigms at any point in time.

Figure 2. A side view of the Instructional Context Design tunnel illustrating the repeating process of moving through novice, advanced, and expert stages of knowledge acquisition over time.



Having visualized the spiral tunnel, we set out to apply it to the instructional design projects in which we were involved: the first in a K-12 setting, the second in a university course. We did not intend to abandon traditional design questions, but hoped, like Cennamo et al. (1995), to shift the emphasis from procedures to process. Beginning at the expert/exit end of the tunnel, we anticipated examining the expert culture for that content domain, and then working back through the spiral to the point at which the novice learner enters the instructional context. As we moved through the tunnel, we hoped to follow the spiral as it wound around the tunnel wall, identifying the specific instructional models most appropriate to the stage of knowledge acquisition represented at each point of the process.

The next two sections describe the experiences each of us had in applying the Instructional Context Design framework (hereafter referred to as ICD). We offer these personal accounts, not as formal research in instructional design, but as real world applications of the framework in the hope of promoting further discussion of, and reflection on, the process of applying a constructivist approach to the design process.

Design into Practice in a K-12 Setting

As an instructional consultant in an elementary school, I am frequently involved with teachers in developing lessons and units of instruction. A teacher will often approach me with an instructional problem, and we will collaborate in creating materials or planning learning activities to address the problem. Since first visualizing the spiral tunnel approach to ICD, I have had several opportunities to apply this process in design projects with teachers.

In one case, a fifth grade teacher approached me with a problem in the reading and language arts curriculum areas. The district curriculum required that a specific research process be taught, and that an example of research writing be included in each student's portfolio. The teacher reported that the research process took up too much instructional time, that the student writing was of poor quality, and that most students, even those who generally enjoyed writing, disliked the research writing process. The challenge was to develop an instructional unit which could be completed by students in about two weeks, which would include the processes and products required by the district curriculum guide, and which would be motivating for more of the students.

We began our design process by visualizing the exit of the tunnel, exploring together the components of the culture of the expert research writer at this level. We consulted curriculum guides, student research writing from past classes, fifth grade student writers, and the experiences of several writing teachers as we constructed our image of the knowledge base, behaviors, attitudes, and products which might characterize a skilled and competent research writer. As we uncovered these characteristics, we were concurrently engaging in a dialogue about the setting in which these expert qualities would be likely to flourish - the cultural context of the expert fifth grade research writer.

As we approached consensus on our vision of the tunnel exit and the emerging expert research writer, we shifted our focus toward visualizing the spiraling tunnel from above. In this phase of the process, we discussed what combination of instructional models might best support a learner moving through the tunnel, engaging in the process of

repeatedly cycling through stages of knowledge acquisition. Shifting our visualization to the tunnel's tri-shaded walls as viewed from its entrance reminded us that at any point in the instructional context, the learner might have need for behavioral, developmental, or apprenticeship instruction. Changing perspective again to visualize the smaller tri-colored bands spiraling around the coils of the tunnel wall helped us to remember that at any point in the instructional process the learner might be functioning as novice, advanced learner, or expert, relative to any particular element of the instructional context. As this phase of visualization proceeded, I became very conscious of Cennamo's comments about the necessity of embracing the complexity of the design process.

The case of the fifth grade research writing project was typical of my experiences using the spiral tunnel visualization, in that just as all the spirals and the considerations they represented began to feel too confusing, the confusion crystallized into some obvious and relatively simple answers. This stage, which I think of as the third and final stage of the visualization process, feels to me both non-linear and systematic. I visualize it as having completed construction of a three dimensional scale model of the tunnel (and the instructional context it represents). At this stage, we can peer into the entrance and exit, and peek through the spiraling walls at any point along their course.

The following paragraph of instructions was the end result of the peeking and poking in the ICD tunnel we constructed for the fifth grade research writing project. These directions were supported by a two-page form, some teacher modeling, a few reference materials, and some student collaboration:

> "You have been hired as a writer by National Geographic World magazine. Your assignment is to write a twenty page short story about a child your age who lives in one of the fifty United States and who has an adventure involving a wild animal. You will soon receive your expense account money and a round trip plane ticket to the state of your choice. Before you leave on this writing assignment, you must provide the magazine editors with a completed story proposal which must include accurate background information on the setting and characters of your proposed story, and a summary of the plot. The editors need your completed story in time to publish it in the September issue, so your plot summary must be on our desk no later than two weeks from today."

The instructional delivery for these materials differed greatly from the previous standard for fifth grade research writing instruction. Faced with an engaging challenge, students collaborated with their teacher and with each other to locate and explore useful reference sources. The teacher modeled the necessary information gathering and organizing skills as she prepared her own story proposal, but spent the majority of the "instructional" time collaborating with individuals and groups as they attempted to refine their data gathering and writing skills.

Two weeks later, twenty nine satisfactorily completed story proposals sat on the teacher's desk, ready for inclusion in the students' writing portfolios. The students, however were not willing to see this project end. They requested and obtained class time to hear each of the story proposals. Several of them used their proposals as the basis for the full length short story which they completed voluntarily at home. The word of mouth advertising for the fifth grade project resulted in a sixth grade teacher adapting the project for her students.

Unlike the course, project, and curriculum designs described by Cennamo et al., Wager et al., and the Cognitive Learning Group, the design process described in detail here took only a few hours over a several days to complete. At first, I questioned using a complex visualization process for such small-scale design projects. However, like Cennamo et al.and Wager et al, I observed that the type of process used influenced the type of product created. In this elementary school setting, the teachers' approaches to instructional delivery appeared to change as they participated in the ICD process.

The structured collaborative design effort, though brief and informal, combined with a non-linear process of context design, consistently resulted in instruction which was perceived as more authentic, engaging, collaborative, and stimulating for students and teachers than traditional classroom instruction. Incorporating the two categorization systems - core instructional models and stages of knowledge acquisition - resulted instructional activities in which students evidenced academic growth while producing products of high quality.

Design into Practice in Higher Education

"Art Media Techniques: Computers" is a required course offered in the post-baccalaureate program in Art Education at the university. The offer to teach this course became an opportunity to redesign its content and approach. Most courses do not require learners to encounter content from two seemingly unrelated perspectives, yet the use of computers in visual arts education demands that both instructional uses and creative expression be addressed, often

simultaneously. Since the experience of producing art with any media is immediate, authentic, and most often happens in real time (Perkins, 1994) a constructivist approach to using the computer as an art medium seemed pretty straightforward and definitely appropriate for the course. Teaching with and about computer technologies as an instructional medium for other aspects of art education from a constructivist philosophy (such as aesthetics, art history, or art criticism), was a taller order. Yet the field of art education and the larger art world has been dealing with the philosophical struggle between modernism and postmodernism since the earliest emergence of such writings. I held firmly to the idea that if any domain could be taught from a constructivist perspective, the most successful and clearly appropriate domain would be the field of art education.

Working from my experience in instructional design and as an art educator, my approach to the design of this course was to first consider the learners and the level of expertise they might be able to attain in the course. Like Wager and Lebow (1995), I spent time gathering information about the previous offerings of the course and about the students' entry level skills through interviews with other instructors and a few of the students who intended to take my course. Based on this information, I considered what these students needed and expected from a course in art education dealing with computer-based technology as both an instructional medium and an art medium.

From the information I had gathered, I first listed the strengths and constraints within which the course would be designed, much as in a traditional design process. In this case, however, rather than focusing on entry level skills needed to complete predetermined goals, the analysis was focused around Jonassen's three levels of knowledge acquisition within the learning context and their potential interactions with Farnham-Diggory's models of learning. The results of this analysis were:

Strengths

- a wide range of student skill and experience levels in art production
- a wide range of student skill and experience levels with computer technology
- an existing collaborative network among the students enrolled for the course
- availability of adequate computer technology in the classroom (PowerMacs, direct Internet connections, classroom LAN, application software)

Constraints

- short duration (the class met 3.5 hours every day for three weeks)
- limited software availability (unable to get certain site licenses)
- delayed installation of promised peripheral hardware

I determined that the level of student expertise envisioned was actually a range of outcomes that could not necessarily be quantified. For some students, expertise might mean moving from a familiarization level to some level of utilization or integration of computer technologies (Hooper & Rieber, in press; Rieber & Welliver, 1989) in their art making or teaching. For others, expertise might mean that they have lost a fear of using a computer or have discovered a previously unexplored use for computers in art.

Thus, the need for a rich learning context that could address the disparate levels of prior knowledge, and the dual role of computers in art, was apparent. Ultimately, I synthesized the purpose of the course into two emphases:

1. to familiarize students with computer-based technologies as a tool for teaching and learning (instructional media) and
2. to introduce students to (or extend their use of) computer-based technologies as art media.

The three week course was then organized around three computer-based projects, written reactions to three critical issues, peer reviews, and an ongoing expectation of in-class collaborative group work. The following paragraphs sketch the process through which some of these course requirements emerged from the ICD framework, and give examples of how the design functioned during the teaching of the course.

In keeping with the constructivist approach of the ICD framework, declarative and basic procedural instruction for each activity were embedded within the larger context of learning about computer-based technologies as instructional media and art media. For example, manuals for software use were available, but no formal instruction was given from the manuals. Rather, I began the course with an exploration of the software in the form of a studio problem as a basis for using the software as an art medium. Since all of the students were able to produce art works in other media, I could assume a certain level of expertise in art. That is, all of the students were at a rather sophisticated level of expertise through acculturation in the art world. They knew the trends, terminology, much of the theory and philosophies of the domain, as well as certain art production skills. The course was designed to provide opportunities and incentives for each student to transfer that knowledge and to build upon it within the context of the course, using the new medium. The

ICD framework became a useful means of visualizing how learners could move through the learning context at different levels of expertise and experiences.

This process worked very well. In Project 1 (exploring the software), each student began with the same digitized DaVinci image, manipulated it using various tools with a variety of software to produce a final image. During the in-class presentations, images were sent via the in-class network from each presenter's computer to other computer screens in the room. Students were able to ask each other how a particular effect was achieved, as well as dialog about the artistic aspects of the images, which increased their computer skills incrementally, as described in Farnham-Diggory's (1994) model of behavioral learning. Thus, the novice computer user was also the expert artist and budding aesthetician, consistent with the spiral, multi-dimensional nature of the ICD framework.

By project 2, the novice computer users became the advanced learners in a developmental stage. Assumptions and personal theories made during their out of class lab work were challenged (or perturbed, as in Farnham-Diggory's model of developmental learning) by more advanced peers or by guest speakers and demonstrations. The ability to immediately try out the "truth" of their personal theories or those of the challengers, particularly in the art production aspect of the course, afforded a rapid advance through the stages of knowledge acquisition .

The projects and small group activities also sparked heated discussions about issues such as the unique attributes of the computer as an art medium, computer software as mimic of other art media, the ownership and originality of images, gender issues, the political implications of access to technology, and school districts' commitment to emerging technologies.

Since debates in the field of art education are currently focused on multiculturalism, educational reform, critical theory, and whether or not to employ a discipline-based approach; I assumed that these issues would also surface during this class. Therefore, three statements were given at the beginning of the course and students were asked to reflect on the implications of computer-based technologies in the arts within the larger context of art education and the socio-cultural milieu. By the end of each week, students were asked to write a brief reaction paper to that week's statement. Course readings, projects, and guest speakers related to the statements provided the rich context for reflecting on the statements.

By far the best measure and evidence of learning in the course, and the success of the instructional design, were the reaction papers. Early in each week of the course, some element of the reaction statement for that week would be addressed, either through class discussions, activities, or a guest speaker. Challenging discussions often prompted students to reconsider certain of their theories or opinions which, on reflection, proved to be not as sound as they had previously thought. In this rich learning context, students would listen to their classmates, read the course readings, and write their reactions based on experience and reflection. The papers were a delight to read and had much to say about authentic learning and about the acculturation process involved in developing expertise, though I have not yet analyzed their content in any formal sense.

Student course evaluations were also revealing. Some students admitted to a new-found courage to using computers in their own teaching, while others moved toward a more integrated level: the computer was already a part of their working life but they now found it could be easily incorporated into their art production. Others remarked that this was the first time they had attended a course which was based on the assumption that they were responsible for building their own knowledge, and marveled that everyone seemed to "get a lot out of" the experience.

Course content and teaching strategies should always be in a state of change. Next year's course will be based on our refined version of the ICD framework, not because it is a good cookbook, but because the framework is sensitive to changes in the context of learning. Next year's level of expertise may be completely different due to the students' entry level, expectations, or area of focus. Since graduate students will be allowed to take the course for graduate credit, we expect an exciting mix of ideas and abilities, and a real challenge to the usefulness of ICD.

Conclusion

Our concept of Instructional Context Design worked well for us as a framework for developing the learning contexts briefly described above. This visual aid or "graphic" was a useful tool for designing and developing courses within the constructivist philosophy. However, for the framework to have any lasting use for us or for others, we as designers, researchers, and practitioners always need to ask questions that concern the usefulness and relevance of any such design and learning model.

As we reviewed our ICD framework and our experiences using it, we referred to two sets of recommendations which have been proposed for evaluating constructivist instructional design and design models: Dunn's (1994) adaptation of formative evaluation questions first posed by Dick and Carey (1990), and Driscoll's (1994) five conditions for

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constructivist learning environments. While it is beyond the scope of this paper to discuss how ICD addresses all ten of these recomendations, we will briefly examine a few selected points in the following discussion.

Dunn adapted questions first posed by Dick and Carey (1990) in the context of formative evaluation of instructivist instructional design models. Like Dunn, we believe these questions to be appropriate for evaluating instructional design, regardless of its over-arching philosophy.

Dunn's modified questions for constructivist design are:

1. Are the materials appropriate to the learning outcome?
2. Do the materials include adequate instruction on the subordinate skills?
3. Are the materials clear and readily understood by representative members of the target group?
4. What is the motivational value of the materials? Do learners find the materials relevant to their needs and interests?
5. Can the materials be managed efficiently in the manner mediated?

While the informality of our design process to date leaves us with only subjective evidence, we are comfortable in responding affirmatively to all five questions. Looking back at our design efforts similar to those which Cennamo et al. (1995) characterize as "process-based" (p. 40), we view elements of that spiral process as supporting the attainment of the results called for in Dunn's questions. Instruction in subordinate skills (question #2), for example, is addressed in ICD through the process of design by spiraling back from expert culture (outcomes) to novice-level (entry skills). Insuring the appropriateness of materials to the learning process (question #1), is achieved by repeatedly addressing the three core instructional models in design, and then again in instructional delivery. The remaining questions (3 through 5) are best answered through observation and interviews with learners in a systemic analysis of the application of the design.

We found that our second set of recommendations, Driscoll's five conditions for constructivist learning environments (Driscoll, 1994), fit very well with our concept of designing spiral learning contexts. Cennamo et al. (1995) consciously adapted Driscoll's five conditions specifically to the design process. However, in Instructional Context Design, the learning context and the design context reflect each other. We have found that focusing attention on the learning context and the facilitation of knowledge construction demands a corresponding shift in the design of instruction.

For example, in item two of her five recommendations for conditions of constructivist learning, Driscoll proposes that "social negotiations [become an] integral part of learning" (Driscoll, 1994, p. 365). Cennamo et al. (1995) proposed that social negotiations become "an integral part of designing the materials" (p. 36). In the ICD process, social negotiations are not only employed in the spiral design process, but are also incorporated as a strategy for learning during instruction. Thus in the ICD framework as we envision it, design and application are tightly (if not inextricably) linked, and may not exhibit a clear distinction between (a) design complexity and the complexity of the learning context, (b) social negotiation during design and within the learning context, (c) examination of multiple perspectives during design and within the leaning context, (d) reflexivity during design and during learning, and (e) client-centered design and student-centered instruction (Cennamo et al., 1995: Driscoll, 1994). We maintain that attention to the context of instruction during the design process provides a critical and necessary interdependence between design processes and learning processes.

This is not to say that designing instruction for constructivist contexts lacks structure or identifiable design procedures. Certain steps, or structural elements, are available for the constructivist instructional designer. Rita Richey (1986) noted that most procedural models (as distinct from conceptual or mathematical models) of instructional design "...reflect current and proposed practice. They identify steps, not relationships among variables; their primary function is to facilitate application, rather than to describe and explain events" (p. 94). Such steps or elements of procedural instructional design models serve as a "...source of knowledge upon which theories can be constructed" (p. 94). Richey synthesized several procedural models and identified six core elements of systematic design processes:

1. Determine learner needs
2. Determine goals and objectives
3. Construct assessment procedures
4. Design and/or select delivery approaches
5. Try out the instructional system and
6. Install and maintain the system

In the ICD framework, experience in terms of the focus on learning contexts, provides the conceptual relationship between the "objectivist" design steps and the "constructivist" concern with complex learning contexts, social negotiations, multiple perspectives, reflexivity, and student-centered instruction (Driscoll, 1994). Richey (1986)

states that "the credibility of experience as a source of knowledge generation depends on the extent to which these experiences are viewed with objectivity and on how broadly they can be applied" (p.94).

Reflecting on the spiral process involved in ICD, and on the organic and participatory nature of the instruction, we examined our learning contexts in terms of the six elements described by Richey as an attempt to "view with objectivity" the usefulness of the ICD framework. In ICD, the elements, which are evident in most instructional design, do not appear as linear and discrete steps in the process, but rather as parts of recurring cycles, or as elements within the organic whole of the instructional context. Learner needs (core element #1) for example, are identified at each stage of the process of tracing back from expert to novice during the design spiral. They are one of the important issues encountered at each level of that analysis. Later during the instruction, as learners move through the instructional context, their needs come into play in the interaction of prior knowledge, instructional models, and levels of learning.

While we conceptualize these steps in ICD as dynamic and continuous stages as learners spiral through the learning context, we agree that it can be useful to consider the stages and levels as if they are discrete entities. From a micro, or analytic, perspective, such consideration can serve as a microscope for identifying the specific instructional components involved in designing a course, lesson, or instructional system. From a macro, or systemic, perspective, the levels and stages can be helpful in providing a broad telescopic view of the complex constellation of elements comprising the whole of an instructional endeavor (Salomon, 1991). We believe this approach to design and instruction results in an emphasis on process rather than steps or procedures, but still addresses the questions and critical issues raised by Dunn, Driscoll, Richey, and others.

Both of our design examples are small and were first time attempts to consciously design from a constructivist perspective. Our materials were never intended for mass production for off-the-shelf curriculum building. However, we will most likely use much of what we have designed and presented here in future courses. We believe that both attempts exhibit sound instructional design qualities, planning, and procedures. We hope that the process described here will aid designers and instructors in their efforts to develop effective means for approaching their tasks from a constructivist perspective.

We have concluded that attention to the context of learning and to how that context facilitates learning, is the "value added" by adopting a constructivist epistemology in instructional design. We do not advocate abandoning concern for the delivery system or the course content, but believe that a visual or graphic framework such as Instructional Context Design may help us avoid approaching instruction and design as if media, method, and application of the design are separate entities.

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